(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 July 2009 (02.07.2009)

PCT

(10) International Publication Number
WO 2009/080326 A1

(51) International Patent Classification:
A61F 2/90 (2006.01)

(21) International Application Number:
PCT/EP2008/010952

(22) International Filing Date:
19 December 2008 (19.12.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/961,754 20 December 2007 (20.12.2007) US

(71) Applicant *(for all designated States except US)*: **ABBOTT LABORATORIES VASCULAR ENTERPRISES LIMITED** [IE/IE]; Earlsfort Center Terrace, Dublin, 2 (IE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **CASEY, Brendan** [IE/IE]; 87 Ros Ard, Cappagh Road, Galway (IE).

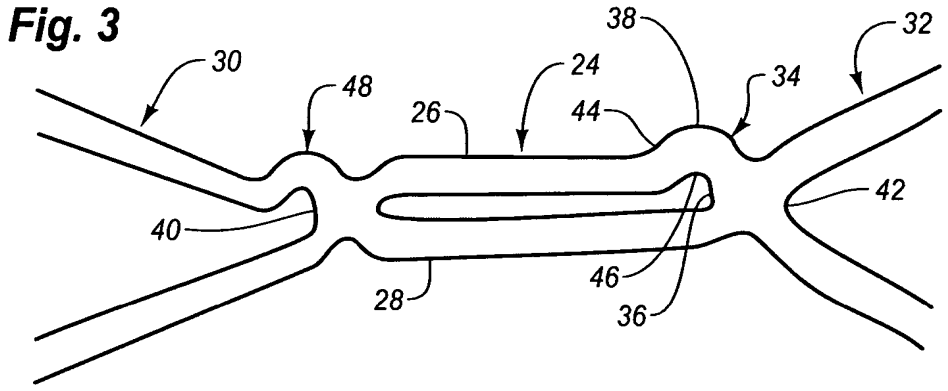
(74) Agents: **PETERS, Hajo** et al.; Graf von Stosch, Patentanwaltsgesellschaft MbH, Prinzregentenstrasse 22, 80538 München (DE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(54) **Title:** ENDOPROSTHESIS HAVING STRUTS LINKED BY FOOT EXTENSIONS



(57) **Abstract:** The present invention relates to an endoprosthesis having a plurality of web rings (30, 32) coupled by connectors (24), which include two or more essentially parallel struts (26, 28) and a foot extension (34) protruding from one of the struts. An endoprosthesis constructed according to the principles of the present invention provides an elevated degree of scaffolding to a body lumen while retaining an acceptable degree of flexibility.

WO 2009/080326 A1

ENDOPROSTHESIS HAVING STRUTS LINKED BY FOOT EXTENSIONS

FIELD OF THE INVENTION

The present invention relates to an endoprosthesis having elevated scaffolding properties while retaining an acceptable degree of flexibility. More particularly, the present invention relates to an endoprosthesis having a plurality of web rings coupled by connectors that are composed of essentially parallel struts and that include a foot extension protruding from one of the struts.

BACKGROUND OF THE INVENTION

Stents, grafts and a variety of other endoprostheses are well known and used in interventional procedures, such as for treating aneurysms, lining or repairing vessel walls, filtering or controlling fluid flow, and expanding or scaffolding occluded or collapsed vessels. Such endoprostheses can be delivered and used in virtually any accessible body lumen of a human or animal and can be deployed by any of a variety of recognized means.

An endoprosthesis is typically delivered by a catheter system to a desired location or deployment site inside a body lumen of a vessel or other tubular organ. To facilitate such delivery, the endoprosthesis must be capable of having a particularly small crossing profile to reach the desired deployment site, which may be difficult to access by the treating physician through the tortuous pathway of the patient's anatomy. Therefore, it would be desirable to provide the endoprosthesis with a sufficient degree of longitudinal flexibility during delivery to allow advancement through the anatomy to the deployed site.

Once deployed, the endoprosthesis should be capable of satisfying a variety of performance characteristics. The endoprosthesis should have sufficient rigidity or outer bias to perform its intended function, such as opening a lumen or supporting a vessel wall. Similarly, the endoprosthesis should have suitable flexibility along its length when deployed so that it will not kink or straighten when deployed in a curved vessel. In certain application, the endoprosthesis should provide an elevated and consistent degree of scaffolding of the vessel wall and prevent plaque from protruding into the artery, for example during the treatment of atherosclerosis in the carotid arteries. Therefore, it would be desirable for the endoprosthesis to provide a substantially uniform or otherwise controlled scaffolding of the vessel wall.

One type of endoprosthesis is the stent, which is used for the treatment of atherosclerotic stenosis in blood vessels. After a patient undergoes a percutaneous

transluminal angioplasty or similar interventional procedure, a stent may be deployed at the treatment site to maintain patency of the vessel. The stent is configured to scaffold or support the treated blood vessel and may be loaded with a beneficial agent, acting as a delivery platform to reduce restenosis or the like.

Numerous endoprosthesis designs and constructions have been developed to address one or more of the performance characteristics summarized above. For example, a variety of stent designs are disclosed in the following patents: U.S. Patent No. 4,580,568 to Gianturco; U.S. Patent No. 5,102,417 to Palmaz; U.S. Patent No. 5,104,404 to Wolff; U.S. Patent No. 5,133,732 to Wiktor; U.S. Patent No. 5,292,331 to Boneau; U.S. Patent No. 5,514,154 to Lau et al.; U.S. Patent No. 5,569,295 to Lam; U.S. Patent No. 5,707,386 to Schnepp-Pesch et al.; U.S. Patent No. 5,733,303 to Israel et al.; U.S. Patent No. 5,755,771 to Penn et al.; U.S. Patent No. 5,776,161 to Globerman; U.S. Patent No. 5,895,406 to Gray et al.; U.S. Patent No. 6,033,434 to Borghi; U.S. Patent No. 6,099,561 to Alt; U.S. Patent No. 6,106,548 to Roubin et al.; U.S. Patent No. 6,113,627 to Jang; U.S. Patent No. 6,132,460 to Thompson; U.S. Patent No. 6,331,189 to Wolinsky et al.; and U.S. Patent No. 7,128,756 to Lowe et al., the entireties of which are incorporated herein by reference.

Certain endoprosthesis structures in the prior art are based on joining a plurality of web rings disposed longitudinally with connectors that increase the flexibility of the endoprosthesis by providing preferred bending points. One example of a stent in the prior art is illustrated in FIG. 1, in which a plurality of web rings 10 (shown in a flattened configuration), are joined one to the other by connectors 12. The individual web rings 10 are formed by a plurality of web elements 14 that are sequentially adjoined at junction bends 16.

While the endoprosthesis of FIG. 1 is shown as having web elements 14 of rectilinear design, endoprosthesis having web elements of different designs are also known in the art. For example, U.S. Patent Application Publication Nos. 2004/0193250 and 2005/0004651, U.S. Patent Nos. 6,682,554 and 6,602,285, International Patent Publication No. WO 00/13611, and German Patent Publication No. 19840645, the entireties of which are incorporated herein by reference, disclose endoprosthesis having web elements each formed by a plurality of segments as illustrated in FIG. 2. More particularly, web rings 18 are each formed by a plurality of crown-shaped web elements 20 and are joined one to the other by connectors 22.

Both of the endoprostheses of FIGS. 1 and 2 include connectors 12 and 22 that are essentially rectilinear in shape. Therefore, those endoprostheses inherently have a limited flexibility and a limited resistance to compressive or torsional forces, for example, to the

forces applied to the endoprosthesis during deployment and after implantation. **In** addition, connectors 12 and 22 offer limited scaffolding to the lumen walls and, if the number of connectors is increased to improve scaffolding (for example, by joining each junction bend in one web ring to a junction bend in a neighboring web ring with a connector), stent flexibility becomes proportionally decreased. Therefore, it would be desirable to provide the endoprosthesis with an elevated degree of scaffolding of the vessel wall while retaining a certain degree of flexibility.

SUMMARY OF THE INVENTION

The present invention relates to an endoprosthesis having a plurality of web rings coupled by connectors, which include two or more essentially parallel struts and a foot extension protruding from one of the struts. An endoprosthesis constructed according to the principles of the present invention provides an elevated degree of scaffolding to a body lumen while retaining an acceptable degree of flexibility.

In one embodiment, the endoprosthesis is configured as a stent defined by a web structure that is expandable from a delivery configuration to a deployed configuration and that is formed by a plurality of longitudinally adjacent web rings. Each of the web rings is defined by web elements that are disposed circumferentially around the longitudinal axis of the stent and that are sequentially adjoined at junction bends. More particularly, a first junction bend in a first web ring is connected to a second junction bend in a second web ring by a connector that includes a pair of struts essentially parallel one to the other and a foot extension joining the first to the second parallel struts.

This foot extension includes a first member that extends from the first strut and that defines the sole portion of the foot extension, and a second member that is interposed between the sole portion and the second strut and that defines the toe portion of the foot extension. Different designs of the sole and toe portions are within the scope of the present invention, for example, the sole portion may be essentially rectilinear in shape and the toe portion essentially arcuate.

In one embodiment, the foot extension couples the first and the second struts of the connector to the second junction bend.

In another embodiment, a second foot extension also couples the first and the second struts of the connector and is aligned circumferentially with, but in a direction opposite to, the first foot extension.

In still another embodiment, a second foot extensions couples the first and the second

struts of the connector to the first junction bend.

In still another embodiment, another foot extension protrudes from the first junction bend and couples the first web ring to the connector.

In still another embodiment, another foot extension protrudes from the second junction bend and couple the second web ring to the connector.

Other foot extensions may protrude from junction bends of the web rings that are not coupled to the connector.

The struts of the connector may be rectilinear in shape or have multi-segment or curved profiles. The struts of the web rings may also be rectilinear in shape, or may include a central member and first and second end members extending from the central member at an obtuse angle to form a crown shape. In the latter embodiment, the web elements are nested one into the other in the contracted delivery configuration and the web elements of neighboring web rings may be oriented at approximately 180 degrees in relation to each other.

The endoprosthesis of the present invention may be configured to self-expand from the contracted delivery configuration to the expanded deployed configuration, or may be deployed by applying a radial pressure to an interior surface of the endoprosthesis, for example, by inflating a balloon disposed within the endoprosthesis.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings constitute a part of this specification and include exemplary embodiments of the invention, which may be embodied in various forms. It is to be understood that in some instances various aspects of the invention may be shown exaggerated or enlarged to facilitate an understanding of the invention.

FIG. 1 illustrates a detail view of the web structure of a first endoprosthesis in the prior art.

FIG. 2 illustrates a detail view of the web structure of a second endoprosthesis in the prior art.

FIG. 3 illustrates a connector having struts linked by a foot extension according to a first embodiment of the invention.

FIG. 4 illustrates a detail view of a web ring in a variant of the embodiment of FIG. 3.

FIG. 5 illustrates a connector having struts linked by foot extensions according to a second embodiment of the invention.

FIG. 6 illustrates a connector having struts linked by foot extensions according to a third embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Detailed descriptions of embodiments of the invention are provided herein. It is to be understood, however, that the present invention may be embodied in various forms. Therefore, the specific details disclosed herein are not to be interpreted as limiting, but rather as a representative basis for teaching one skilled in the art how to use the present invention in virtually any detailed system, structure or manner.

The present invention relates to an endoprosthesis for delivery within a body lumen that is formed by a plurality of web rings coupled by connectors, which include two or more essentially parallel struts and a foot extension protruding from one of the struts. Additional foot extensions may also protrude from the web rings.

An endoprosthesis constructed according to the principles of the present invention provides an elevated degree of scaffolding to a body lumen but retains an acceptable degree of flexibility. The endoprosthesis may be configured as a stent, graft, valve, occlusive device, trocar or aneurysm treatment device and may be used for a variety of intralumenal applications, including vascular, coronary, biliary, esophageal, renal, urological and gastrointestinal. For ease of description and without restrictive intent, an embodiment of the present invention will be described hereinafter with reference to a stent.

FIG. 3 illustrates a connector 24 that connects a first web ring 30 to a second web ring 32 in a stent and that includes two essentially parallel struts 26 and 28. While struts 26 and 28 are shown as rectilinear in shape, struts 26 and 28 may each be formed by a plurality of segments to provide a "V", "W", or similar shape, or may be curved. FIG. 3 also shows that struts 26 and 28 may connect first and second web rings 30 and 32 at points that are longitudinally aligned, providing connectors 24 with a direction essentially parallel to the longitudinal axis of the stent after the stent is expanded. In other embodiments, connectors 24 may have a transversal direction in relation to the longitudinal axis of the stent after expansion, in the manner shown in FIG. 2.

A foot extension 34 couples strut 26 to strut 28 at one end of connector 24 and includes a sole portion 36 that continues into a toe portion 38, which is interposed between sole portion 36 and strut 26. Sole portion 36 and toe portion 38 may each have a variety of shapes, providing foot extension 34 with a variety of configurations. For example, sole portion 36 may be essentially rectilinear with curved end connections to struts 26 and 28, or

have an arcuate shape, while toe portion 38 instead may be arcuate in shape, as shown in FIG. 3, or have a multi-segmented shape. Different possible configurations of the sole and toe portions of a foot extension are disclosed in U.S. Patent No.7, 128,756 to Lowe et al. and in U.S. Patent Application Publication Nos.2005/0107865 to Clifford et al., 2006/0015173 to Clifford et al., 2006/0142844 to Lowe et al., 2007/0021834 to Young et al., and 2007/0021827 to Lowe et al., the entireties of which are incorporated herein by reference.

As shown in FIG. 3, connector 24 couples a first junction bend 40 on first web ring 30 to a second junction bend 42 on second web ring 32. Also as shown in FIG. 3, foot extension 34 may be positioned on connector 24 to operate as the coupling area between connector 34 and junction bend 42, causing sole portion 36 and junction bend 42 to be integrally adjoined.

Connector 24 provides the stent with improved radial strength and also with improved scaffolding properties due to the two parallel struts included within connector 24 as compared to stents having connectors with a single strut; for example, as compared to the stents depicted in FIGS. 1 and 2. Further, the increased stent surface density provided by the pair of struts 26 and 28 in comparison with single strut connectors provides an additional barrier to prevent plaque from protruding into the artery.

While providing increased scaffolding properties, connector 24 retains a level of flexibility that is adequate for a variety of angioplasty applications because foot extension 34 includes areas of flexure 44 and 46. Moreover, foot extension 34 provides the stent with a lower risk of sliding after the stent is crimped on a balloon than a straight connector, because resistance to sliding increases in proportion to the amount of metal segments disposed circumferentially in relation to metal segments extending longitudinally.

Both struts 26 and 28 and foot extension 34 are produced from the same material, but in one embodiment of the invention, one of the two struts 26 or 28 is produced from a durable material while the other strut is produced from a biodegradable material. For example, strut 26 may be produced from a metal material such as stainless steel or Nitinol (when the stent is self-expanding), while strut 28 may be produced from a polylactic acid (a biodegradable polyester derived from lactic acid). Either or both of struts 26 or 28 may also be coated with a therapeutic material, for example, a restenosis-inhibiting material or an immunosuppressant such as everolimus.

Referring now to FIGS. 3 and 4, a foot extension 48 may also be positioned in first web ring 30, as shown in FIG. 3, and/or in second web ring 32. Foot extension 48 may have the same profile as foot extension 34 situated in connector 24 or may have a different profile. For example, as shown in FIG. 4, foot extension 48 may include a sole portion 50 essentially

rectilinear in shape and a toe portion 52 essentially arcuate in shape, but any of the foot extension profiles previously described with regard to connector 24 may be used in first web ring 30.

It should be noted that foot extensions 48 are not necessarily disposed on first web ring 30 and/or 32 only at the junctions with connectors 24, but may be present also in parts of web rings 30 and/or 32 that are not coupled to connectors 24. Examples of possible dispositions of foot extensions 48 on web rings are disclosed in the above mentioned U.S. Patent No. 7,128,756 to Lowe et al. and in U.S. Patent Application Publication Nos. 2005/0107865 to Clifford et al., 2006/0015173 to Clifford et al., 2006/0142844 to Lowe et al., 2007/0021834 to Young et al., and 2007/0021827 to Lowe et al.

Referring now to FIGS. 5 and 6, other embodiments of the invention include connectors that have a plurality of foot extensions. More particularly, FIG. 5 illustrates an embodiment of the invention, in which a connector 54 includes first strut 56 and second strut 58, disposed essentially one parallel to the other, and first foot extension 60 and second foot extension 62 disposed one opposite to the other, with foot extension 60 protruding from strut 56 and foot extension 62 protruding from strut 58. This design provides the stent with greater ability to absorb torsional stresses than the design of FIG. 3.

Another embodiment of the invention is illustrated in FIG. 6, in which connector 64 includes first strut 60 and second strut 68 disposed one parallel to the other and also includes first foot extension 70 and second foot extensions 72 both protruding from opposite ends of strut 66. This design provides the stent with greater ability to absorb bending stresses than the design of FIG. 3.

The embodiments of FIGS. 3- 6 are to be considered non-limiting, and other embodiments of the invention may include foot extensions that protrude from each of the connectors struts but that are not aligned circumferentially, or more than two foot extensions disposed on different points of the connector.

In each of the embodiments of FIGS. 5 and 6, foot extensions may also be disposed on the first and/or second web rings, in the same manner as described with regard to the embodiment of FIG. 3.

The embodiments described hereinbefore have been illustrated with regard to web elements formed by essentially rectilinear struts 70, as shown in FIG. 4, which are sequentially joined either by junction bends 72 or by foot extensions 48.

It should be noted that the connector of the present invention finds equal applicability in web rings formed by web elements of different shapes. For example, the web **elements**

may be shaped as the crowns illustrated in FIG. 2, in which each of the web elements is formed by a central member, disposed essentially parallel to the longitudinal axis of the stent in the contracted delivery configuration, and by a first and a second end members extending from opposite ends of the central member at obtuse angles. Such obtuse angles may be the same or different. The crowns are joined sequentially with junction bends that have arcuate shapes and, in the contracted delivery configuration, are nested one into the other. The crowns of neighboring web rings may be disposed in opposite directions, that is, the crowns in one web ring may be disposed at 180 degrees compared to the crowns of a neighboring web ring.

A person skilled in the art will appreciate that web elements of still different shapes may be **employed** in constructing the web rings and that such alternative designs all fall within the spirit and scope of the present invention.

The web rings of the endoprosthesis may be manufactured from a variety of **biocompatible** materials known in the art, including metal and plastic materials, and may be deployed at a target vessel using techniques also known in the art, either by inflating a balloon coupled to the catheter or, if the endoprosthesis is manufactured from a shape memory material such as Nitinol (a nickel-titanium alloy), by allowing the endoprosthesis to self-expand until contact with the vessel wall is established.

While the invention has been described in connection with the above described embodiments, it is not intended to limit the scope of the invention to the particular forms set forth, but on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may be included within the scope of the invention. Further, the scope of the present invention fully encompasses other embodiments that may become obvious to those skilled in the art and the scope of the present invention is limited only by the appended claims.

CLAIMS

What is claimed is:

1. An endoprosthesis for delivery in a body lumen comprising:

a web structure defining an essentially tubular body expandable from a contracted configuration to an expanded configuration;

a plurality of longitudinally adjacent web rings defining the web structure; and

a plurality of sequentially adjoined web elements defining the web rings, the web elements being disposed substantially parallel to a longitudinal axis of the essentially tubular body when in the contracted configuration, pairs of the web elements being sequentially adjoined at junction bends,

wherein a first junction bend in a first web ring is connected to a second junction bend in a second web ring by a connector having a first and a second struts essentially parallel one to the other,

wherein a first foot extension joins the first to the second struts, and

wherein the first foot extension includes a first member extending from the first strut and providing the sole portion of the first foot extension, and a second member interposed between the sole portion and the second strut and providing the toe portion of the first foot extension.

2. The endoprosthesis of claim 1, wherein the sole portion has an essentially rectilinear shape and the toe portion has an essentially arcuate shape.

3. The endoprosthesis of claim 1, wherein the first foot extension couples the first and the second struts of the connector to the second junction bend.

4. The endoprosthesis of claim 3, further comprising a second foot extension joining the first to the second struts, wherein the second foot extension is aligned circumferentially with and disposed in a direction opposite to the first foot extension.

5. The endoprosthesis of claim 3, further comprising a second foot extensions joining the first to the second parallel struts, wherein the second foot extension couples the first and the second struts of the connector to the first junction bend.

6. The endoprosthesis of claim 1, further comprising a third foot extension protruding from the first junction bend and coupling the first web ring to the connector.

7. The endoprosthesis of claim 1, further comprising a fourth foot extension protruding from the second junction bend and coupling the second web ring to the connector.

8. The endoprosthesis of claim 6, wherein the first and/or the second web rings comprise foot extensions extending from junction bends not coupled to the connector.

9. The endoprosthesis of claim 1, wherein the endoprosthesis is a stent.

10. The endoprosthesis of claim 1, wherein the first and the second struts are rectilinear.

11. The endoprosthesis of claim 1, wherein the first and the second struts have multi- segment or curved profiles.

12. The endoprosthesis of claim 1, wherein the web elements are rectilinear in shape.

13. The endoprosthesis of claim 1,

wherein each of the web elements comprises a central member having a first and a second ends,

wherein the central member is disposed essentially parallel to the longitudinal axis in the contracted configuration,

wherein the central member is connected at the first end to a first end member at a first obtuse angle, and

wherein the central member is connected at the second end to a second end member at a second obtuse angle.

14. The endoprosthesis of claim 13, wherein the first and the second obtuse angles are

essentially equal.

15. The endoprosthesis of claim 13, wherein the web elements of each web ring are nested one into the other in the contracted delivery configuration, and wherein the junction bends have an arcuate shape.

16. The endoprosthesis of claim 13, wherein the web elements in the first web ring are oriented at approximately 180 degrees in relation to the web elements in the neighboring web ring.

17. The endoprosthesis of claim 1, wherein the web structure is configured to self-expand from the contracted configuration to the expanded configuration.

18. The endoprosthesis of claim 1, wherein the web structure is configured to expand from the contracted configuration to the expanded configuration by application of a radial pressure to an interior surface of the essentially tubular body.

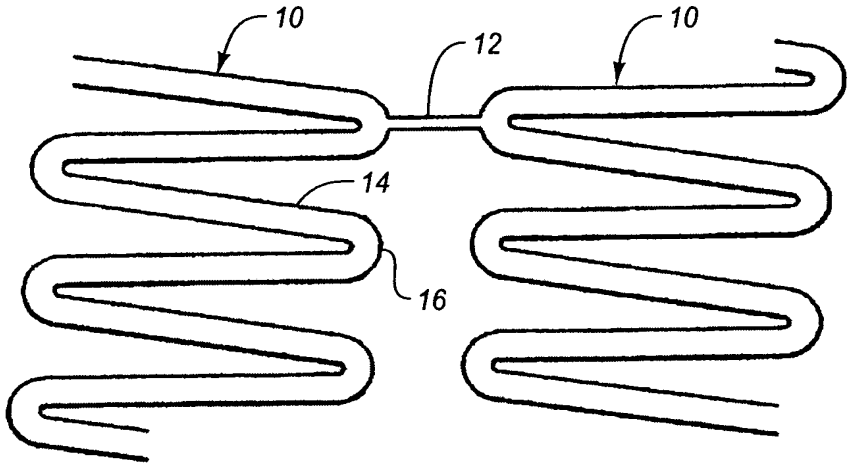


Fig. 1
(Prior Art)

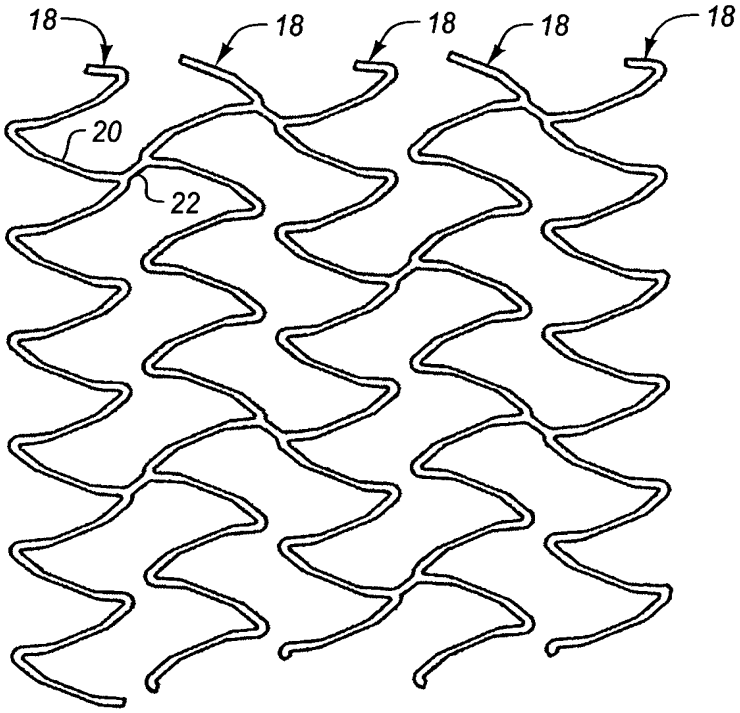


Fig. 2
(Prior Art)

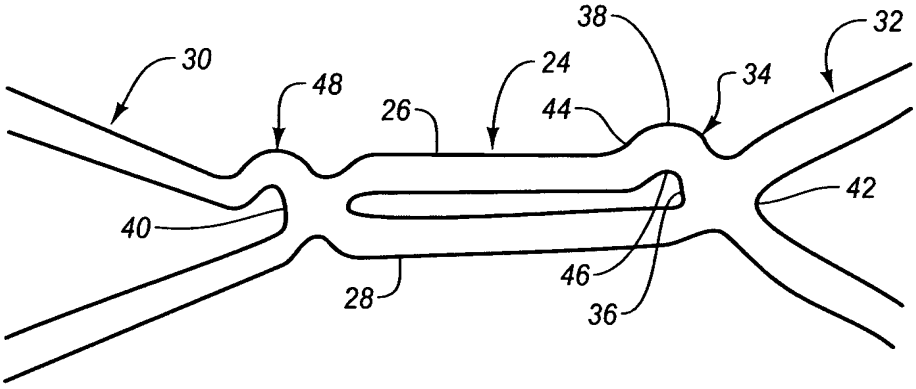


Fig. 3

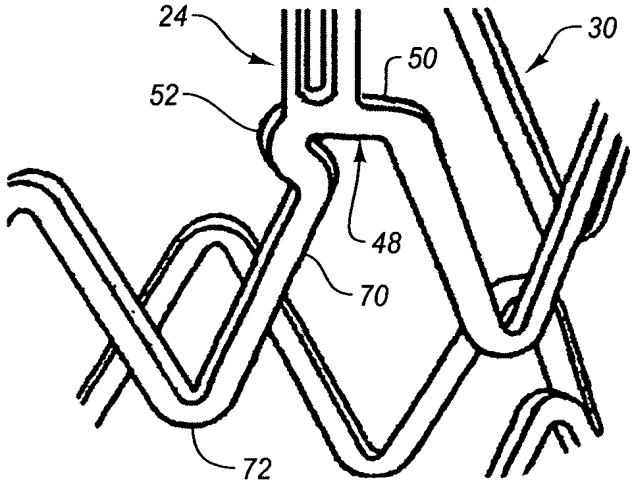


Fig. 4

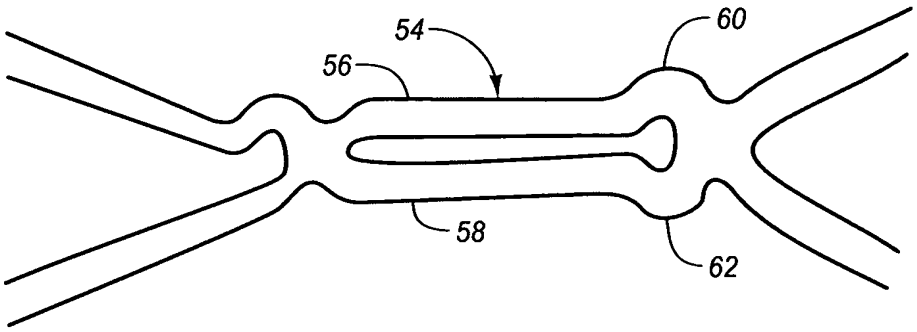


Fig. 5

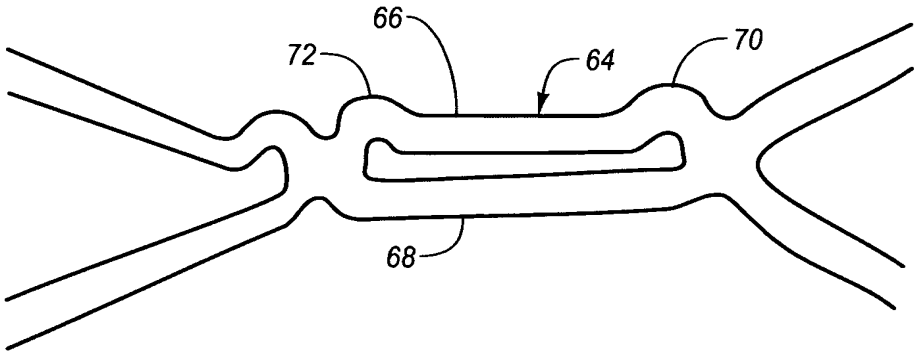


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/010952

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F2/90

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/230293 A1 (YIP PHILIP S [US] ET AL) 18 November 2004 (2004-11-18)	1,2,9, 10,12, 17,18
Y	paragraphs [0081], [0093], [0105]; figures 37,38	13-16
X	WO 2006/099449 A (ABBOTT LAB [US]; NEWHAUSER RICHARD [US]; YRIBARREN TRAVIS R [US]) 21 September 2006 (2006-09-21)	1,2, 8-10,12, 17,18
Y	page 8, line 3 - page 9, line 20; figures 1,7A-7B,9A-9B	13-16
X	EP 1 095 631 A (BIOTRONIK MESS & THERAPIEG [DE]) 2 May 2001 (2001-05-02)	1,3-7,9, 10,12, 17,18
	paragraphs [0032] - [0036]; figures 1-3	

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 May 2009	04/06/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Portoni, Luisa

3

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/010952

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 2008/042618 A (ABBOTT CARDIOVASCULAR SYSTEMS [US]; KREIDLER MARC C [US]; MILLER JESSI) 10 April 2008 (2008-04-10) claim 12; figures 8,9,19	1-3,9, 10,17,18
Y	US 2002/019660 A1 (GIANOTTI MARC [CH] ET AL) 14 February 2002 (2002-02-14) paragraphs [0012] - [0014], [0043] - [0049]; figures 1-4	13-16
A	WO 2006/055533 A (ABBOTT LAB [US]; CLIFFORD ANTON [US]; KANG KEVIN [US]; PAPPAS JEFF [US) 26 May 2006 (2006-05-26) paragraphs [0049] - [0057]; figures 1A-11,20-24F	1-9,12

3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2008/010952

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004230293 A1	18-11-2004	NONE	
WO 2006099449 A	21-09-2006	EP 1858444 A2	28-11-2007
		US 2007213810 A1	13-09-2007
EP 1095631 A	02-05-2001	DE 19951475 A1	10-05-2001
		US 6596021 B1	22-07-2003
WO 2008042618 A	10-04-2008	US 2008086194 A1	10-04-2008
US 2002019660 A1	14-02-2002	AU 2002253407 A1	28-08-2002
		WO 02064061 A2	22-08-2002
		US 2006184232 A1	17-08-2006
		US 2004193250 A1	30-09-2004
		US 2004243220 A1	02-12-2004
		US 2002035394 A1	21-03-2002
WO 2006055533 A	26-05-2006	EP 1811926 A2	01-08-2007